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# Materials Science and Technology Division

The Materials Science and Technology (MST) Division provides scientific and technical leadership in materials science and technology for the Los Alamos National Laboratory. We support a wide range of programs, including nuclear weapons stockpile stewardship, stockpile support, non-nuclear defense, energy, environment, industrial competitiveness, and strategic research. We integrate state-of-the-art capabilities in materials synthesis, fabrication, characterization, processing, and modeling to help solve technical problems of national importance.



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## Center for Materials Science

The Center for Materials Science (CMS) supports interactive, interdisciplinary, and multi-organizational research in materials science and technology. We support and operate central materials science research facilities, conduct materials science research, and manage and develop materials science programs. Our facilities include an electron microscopy laboratory and an ion beam materials laboratory. Research projects include amorphous alloys and metastable microstructures, polycrystal plasticity and materials texture, very high temperature materials, materials analysis using ion beams, ultra-high strength materials, theory of strongly correlated electronic materials, dynamic deformation of materials, self assembling and photoreactive materials, and f-electron physics. We are also responsible for the program management functions for the DOE Division of Materials Sciences.

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## Superconductivity Technology Center

The Superconductivity Technology Center (STC) coordinates a multidisciplinary program for research, development, and technology transfer in the area of high-temperature superconductivity. Our focus is on effective collaborations with American industry, universities, and other national laboratories to develop electric power and electronic device applications of high-temperature superconductors. Outstanding scientific research projects underpin our international leadership position and provide the basis for technical advances. Applied research and development efforts include powder synthesis, wire/coil processing, thin/thick film deposition, characterization of microstructural and superconducting properties, power cryogenic engineering, and prototype device development. Individuals from several Los Alamos organizations are a part of this team effort to evolve this exciting technology.

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## National High Magnetic Field Laboratory Center

The National High Magnetic Field Laboratory (NHMFL) Center executes the NSF-funded NHMFL pulsed field facility national user program under contract with Florida State University and aligned DOE high magnetic field programs. The Center catalyzes research in high magnetic fields, develops collaborations with the University of California in high magnetic field research, develops synergistic programs with the LANSCE national user program for neutron scattering, and is the home of Florida State and University of Florida personnel assigned to Los Alamos.



## Materials Technology: Metallurgy

The Materials Technology: Metallurgy Group (MST-6) specializes in metallurgical engineering of non-radioactive metals and alloys. We support eight specialized technology areas: corrosion and interfaces; alloy design and development; microscopy and characterization; mechanical fabrication; welding



and joining; foundry and machine shop; powder metallurgy; and electrochemistry. Currently we have over 100 active programs with the major efforts in component and prototype fabrication, materials for the solid storage of hydrogen, waste minimization for weapons fabrication processes, corrosion monitoring of weapons and accelerator components, and nuclear weapons component rebuild. We support collaborative programs with industry, such as work with the aluminum industry on the use of lightweight materials for transportation. We are developing materials for kinetic energy penetrators, shaped charge liners, explosively formed penetrators, and other conventional defense programs.

Our research interests include the synthesis and processing of alloys with emphasis on beryllium and uranium, intermetallic composites, advanced nuclear fuels, interactions between lasers and weldable materials, materials characterization (especially texture and anisotropy), rapid prototyping, corrosion, and process modeling of solidification of metals.

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## Polymers and Coatings

The Polymers and Coatings Group (MST-7) maintains the Laboratory's expertise in polymer sciences, chemical vapor deposition, physical vapor deposition, precision machining, and fabrication of experimental packages for the Inertial Confinement Fusion (ICF) and High Energy Density Physics (HEDP) programs. In addition, we operate the Laboratory's glass shop as an institutional service. We maintain a broad program base including energy, environment, nuclear weapons, conventional defense, and industrial collaborations. This program base is founded in materials synthesis, processing, patterning, and characterization and includes efforts in chemical vapor deposition of oxide, nitride, and diamond coatings; chemical vapor infiltration; preparation of oriented films and multilayer coatings; sensors; membranes for separations; elucidation of the mechanisms of polymer aging, polymer foams, and filled foams; high energy density materials; target technology; thermal barrier coatings; flat panel display materials technology; and superconducting coatings. We also have an extensive set of chemical and physical characterization capabilities. In collaboration with MST-6, we use scanning electron microscopy and metallography to examine tritium-contaminated materials of interest to the nuclear weapons program.



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## Structure/Property Relations

The Structure /Property Relations Group (MST-8) provides a laboratory focus on expertise and facilities used to evaluate and understand the relationships between material properties and their underlying



structures. The represented capabilities reflect both a broad suite of state-of-the-art material structure and property evaluation methods, as well as a number of specialized facilities to carry out materials research for a variety of laboratory programmatic missions. The group possesses expertise in x-ray and neutron scattering, electron and scanning probe microscopies, and ion microprobe analysis of materials. Specific focus areas include experimental mechanics, dynamic materials properties, ion/solid interactions and interface engineering, metastable materials, multilayers, materials and process simulation, single crystal synthesis, functionally graded materials, high-temperature structural materials, radiation tolerant ceramics, and optically functional materials.

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## Condensed Matter and Thermal Physics



The Condensed Matter and Thermal Physics Group (MST-10) emphasizes fundamental research on condensed matter. We have three complementary thrusts: characterizing and understanding the physics of materials, particularly those with unusual superconducting, magnetic, and semiconducting groundstates; application of materials characterization capabilities to industrial, security, and energy-related technologies; and the study and application of fluid dynamics and thermodynamics to non-linear science and refrigeration. Many of these activities require our expertise in cryogenics.

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## Electronic and Electrochemical Materials and Devices

The Electronic and Electrochemical Materials and Devices Group (MST-11) conducts basic and applied research on electrically and ionically conducting materials, including the development of novel materials characterization approaches. Our research forms a basis for development in device technology and practical application of materials. Our major projects include the fuel cell core research program, electrochemical capacitor development, electrochemical reactor development, fundamental research on catalysis, thin-film sensor technology for chemical and biochemical detection, thin-film superconducting device development, the characterization of plutonium alloys through x-ray absorption spectroscopy, ultrafast optical diagnostics, acoustic nondestructive testing for chemical and biological agent detection, and basic and applied work on electroluminescent polymers. We support a suite of capabilities in materials and device development and characterization, which we use extensively in multiple collaborations with industry.

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